Selective visual attention for *in vitro* neural stimulation

INI-508: Neuromorphic Intelligence
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Class Project Report
Simon Steffens

1. Introduction & Motivation

1.1 Biohybrid vision implant

The overarching project inspiring this work is the endeavour of building a brain machine interface that uses ectopic axons as electrodes. This approach is motivated by the limitations of current technology to deliver high-density stimulation in the brain with spatial resolution beyond large neural populations. While recording technologies have made considerable progress over the last decades, stimulation methods have not kept up. In medical applications, deep brain stimulation of basal ganglia has received a lot of attention over the last years, especially due to the remarkable improvements for patients suffering from Parkinson disease. Still, these systems suffer from a range of shortcomings that limit their utility in other settings: first and foremost, the spatial resolution of stimulation is limited to neural populations or entire nuclei, second, immunoreaction to the implanted electrodes causes complications in the long term, and lastly, these systems are limited in their adjustability post surgery, as voltage and pulse width are the only tunable parameters. Our biohybrid multielectrode array (bioMEA) aims to achieve stimulation at single-neuron resolution while simultaneously resolving the latent issue of biocompatibility encountered with implanted metal electrodes. Such single-cell resolution interfaces are most likely required for delivering high dimensional information, for example visual input. Our biohybrid interface will be implanted in the dorsal lateral geniculate nucleus (dLGN) restoring the visual input as depicted in Figure **??** below.

t: 0.03 s, T: 33.0 ms, FPS: 30

Webcam video

Simulated events